CLAIMS

WE CLAIM:

1. A hand-held laser fusion welding assembly, comprising:

a main body dimensioned to be grasped by a hand and adapted to couple to a laser delivery system, a gas supply system, and a coolant supply system, the main body having an internal gas flow passage and one or more coolant flow passages extending therethrough; and

a nozzle coupled to the main body, the nozzle having at least an aperture in fluid communication with the internal gas flow passage through which laser light from the laser delivery system and gas from the gas supply system may pass.

2. The assembly of Claim 1, further comprising:

an end cap coupled to the main body second end, the end cap including:

an optical cable opening adapted to receive an optical cable,

a gas flow passage in fluid communication with the main body gas flow passage, and

one or more coolant flow passages each in fluid communication with one of the main body coolant flow passages.

3. The assembly of Claim 2, further comprising:

one or more filler media delivery flow passages extending through the main body; and

one or more filler media delivery flow passages extending through the end cap, each end cap filler media delivery flow passage adapted to receive a filler media therein, and each in fluid communication with one of the main body filler media delivery flow passages.

4. The assembly of Claim 3, further comprising:

one or more filler media liner tubes, each liner tube disposed at least partially within one of the end cap filler media delivery flow passages and one of the main body filler media delivery flow passages.

5. The assembly of Claim 1, further comprising:

an optics assembly mounted within the main body and configured to focus the laser light from the laser delivery system on a point in front of the nozzle aperture.

6. The assembly of Claim 5, wherein the optics assembly comprises:

a lens conduit having at least a first end and a second end;

a first lens mounted within the lens conduit adjacent the lens conduit first end, the first lens configured to collimate the laser light from the laser delivery system; and

a second lens mounted within the lens conduit adjacent the lens conduit second end, the second lens configured to focus the collimated laser light on the point in front of the nozzle aperture.

7. The assembly of Claim 6, wherein at least the first lens is movably mounted within the lens conduit, and wherein the assembly further comprises:

a receptacle assembly mounted within the main body adjacent the lens conduit first end, the receptacle assembly adapted to receive an optical cable through which the laser light from the laser delivery system is transmitted; and

an optical adjustment screw movably mounted within the lens conduit adjacent the first lens, the optical adjustment screw configured to adjust a spacing between the first lens and the receptacle assembly, whereby the collimation of the delivered laser light is adjustable.

8. A laser fusion welding system, comprising:

a gas supply system configured to supply a flow of gas;

a coolant supply system configured to supply a flow of a coolant medium;

an optical cable coupled to a laser delivery system and configured to transmit laser light therethrough; and

a hand-held laser fusion welding assembly including:

a main body dimensioned to be grasped by a hand and coupled to the optical cable, the main body including (i) an internal gas flow passage extending therethrough and in fluid communication with the gas supply system, and (ii) one or more coolant flow passages extending therethrough, each coolant flow passage in fluid communication with the coolant supply system, and

a nozzle coupled to the main body, the nozzle having at least an aperture in fluid communication with the internal gas flow passage through which laser light transmitted through the optical cable may pass and the flow of gas from the gas supply system may pass.

9. The system of Claim 8, further comprising:

one or more filler media liner tubes, each liner tube disposed at least partially within one of the main body filler media delivery flow passages,

wherein the filler media supplied from the filler media delivery system either flows or extends through one or more of the liner tubes.

10. The system of Claim 8, further comprising:

an end cap coupled to the main body second end, the end cap having an optical cable opening through which the optical cable extends, and one or more filler media delivery flow passages each in fluid communication with one of the main body filler media delivery flow passages and coupled to receive the filler media supplied from the filler media delivery system.

11. The system of Claim 10, further comprising:

one or more filler media liner tubes, each liner tube disposed at least partially within one of the end cap filler media delivery flow passages and one of the main body filler media delivery flow passages,

wherein the filler media supplied from the filler media delivery system either flows or extends through one or more of the liner tubes.

12. The system of Claim 8, wherein the filler media delivery system comprises:

a wire feeder; and

one or more strands of wire filler media coupled to the wire feeder.

13. The system of Claim 8, wherein the filler media delivery system comprises:

a container having an inner volume;

powder filler media disposed within the container inner volume; and

one or more conduits, each conduit in fluid communication with the container inner volume and a main body filler media delivery flow passage.

14. The system of Claim 8, wherein the filler media delivery system comprises:

a container having an inner volume;

liquid filler media disposed within the container inner volume; and

one or more conduits, each conduit in fluid communication with the container inner volume and a main body filler media delivery flow passage.

15. The system of Claim 8, further comprising:

an optics assembly mounted within the main body and configured to focus the laser light from the laser delivery system on a point in front of the nozzle aperture.

16. The system of Claim 15, wherein the optics assembly comprises:

a lens conduit having at least a first end and a second end;

a first lens mounted within the lens conduit adjacent the lens conduit first end, the first lens configured to collimate the laser light from the laser delivery system; and

a second lens mounted within the lens conduit adjacent the lens conduit second end, the second lens configured to focus the collimated laser light on the point in front of the nozzle aperture.

17. The system of Claim 16, wherein at least the first lens is movably mounted within the lens conduit, and wherein the system further comprises:

an optical cable through which the laser light from the laser delivery system is transmitted;

a receptacle assembly mounted within the main body adjacent the lens conduit first end, the receptacle assembly coupled to the optical cable; and

an optical adjustment screw movably mounted within the lens conduit adjacent the first lens, the optical adjustment screw configured to adjust a spacing between the first lens and the receptacle assembly, whereby the collimation of the delivered laser light is adjustable.

18. A hand-held laser fusion welding assembly, comprising:

a main body dimensioned to be grasped by a hand and adapted to couple to a laser delivery system and to a gas supply system, the main body having an internal gas flow passage extending therethrough; and

a nozzle coupled to the main body, the nozzle having at least an aperture in fluid communication with the internal gas flow passage through which laser light from the laser delivery system and gas from the gas supply system may pass.

19. A hand-held laser fusion welding assembly, comprising:

a main body dimensioned to be grasped by a hand and adapted to couple to a laser delivery system and a coolant supply system, the main body having one or more coolant flow passages extending therethrough; and

a nozzle coupled to the main body, the nozzle having at least an aperture through which laser light from the laser delivery system may pass.